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Asteroids and Comets: Future Imaging Opportunities with Earth-Based Radar Systems

D.B. Campbell, G.J. Black (Cornell University) and S.J. Ostro (JPL)

Major improvements **currently** underway to the Arecibo 305m antenna and λ 13cm radar system will increase the radar system's sensitivity by a factor of about 20. Recent upgrades to the Goldstone λ 3.5cm radar system have also improved its sensitivity. While the Arecibo system will have significantly greater sensitivity than Goldstone, the Arecibo antenna's limited dedication coverage of -2° to $+38^\circ$ means that the Goldstone system will be important for the investigation of near-earth objects with declinations outside this range. Over one hundred main belt and near-earth asteroids **per year** will be observable with the new Arecibo system, and there will be a number of good imaging opportunities each year. While only a few imaging opportunities are predicted for comets over the next 10 years, the system will be able to respond to unexpected cometary opportunities such as that for Comet IRAS-Araki-Alcock, which approached to within 0.03 AU of the Earth in 1983. For sufficiently close objects, both the Arecibo and Goldstone systems are capable of delay-Doppler imaging at 20m resolution. However, the ambiguities inherent in the delay-Doppler technique can make these images difficult to interpret, and new approaches are needed. We are currently investigating the applicability of VLB techniques to the direct synthesis of images of asteroids and comets illuminated by a radar signal. For example, at λ 3.5cm, the newly-completed Very Long Baseline Array (VLBA) will have approximately 50m resolution at the distance of Geographos during its close approach to the Earth in late August / 1994. While the sensitivity of Goldstone-VLBA will not sustain 50m resolution and problems related to sidelobe response may be difficult to solve, the resultant image would be several pixels across and should provide complementary information to that from delay-Doppler imaging. A similar opportunity for Goldstone-VLBA observations of 1991 IX will occur in June 1995.

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Cornell University

First Author's Address - Print

528 Space Sciences Bldg.

Ithaca, NY 14853-6801

D.B. Campbell

Signature of First Author

Signature of Introducing Member,
if Author is a Nonmember

Phone: (607) 255-3735

FAX: (607) 255-8803

E-mail: campbell@astro.sun.tn.
cornell.edu

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